UM PATENT DEP. OLEN





#### PCT

### WORLD INTELLECTUAL PROPERTY ORGANIZATION International Bureau

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(72) Inventors; and

- (75) Inventors/Applicants (for US only): STRAUVEN, Yvan [BE/BE]; Hayenhoek 29, B-3910 Neerpelt (BE). GAY, Bruno [BE/BE]; 265, rue de Noyer, B-1000 Bruxelles (BE).
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#### Published

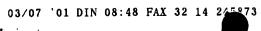
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

#### (54) Title: CENTRIFUGALLY ATOMIZED ZINC ALLOY POWDER FOR ALKALINE BATTERIES

#### (57) Abstract

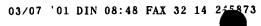
This invention relates to centrifugal atomized zinc alloy powders for alkaline batteries consisting of (a) 0.005-2 % by weight of indium, and 0.005-0.2 % by weight of either one of Al and Bi, or (b) 0.005-2 % by weight of indium, and 0.005-0.2 % by weight of Bi, and 0.001-0.5 % of either one or both of Al and Ca, or (c) 0.005-2 % by weight of either one or both of Bi and Al, and 0-0.5 % by weight of Pb, the remainder being zinc. The powder is obtained by centrifugal atomisation in a protective atmosphere, where the oxygen content is less than 4 % by volume. The resistance to corrosion in the electrolyte of the battery, especially after partial discharge, is markedly better than when the same alloys are prepared by the traditional production process. The capacity of batteries containing these powders is very good.



#### INTERNATIONAL SEARCH REPORT

anal Application No PCT/EP 00/00932

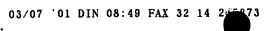
A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01M4/42 C220 C22C1/04 B22F9/10 According to International Patent Classification (IPC) or to both national classification and IPC B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) H01M C22C B22F IPC 7 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) C. DOCUMENTS CONSIDERED TO BE RELEVANT Category \* Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No. χ PATENT ABSTRACTS OF JAPAN 1-10 vol. 013, no. 254 (E-772). 13 June 1989 (1989-06-13) & JP 01 052379 A (MITSUI MINING & SMELTING CO LTD; OTHERS: 01) 28 February 1989 (1989-02-28) abstract PATENT ABSTRACTS OF JAPAN X 1-10 vol. 010, no. 228 (E-426), 8 August 1986 (1986-08-08) -& JP 61 064074 A (TOSHIBA BATTERY CO LTD), 2 April 1986 (1986-04-02) abstract -/--Further documents are listed in the continuation of box C. Patent family members are listed in annex. Special categories of cited documents ; "T" later document published after the international filing date "A" document defining the general state of the art which is not considered to be of particular relevance or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention earlier document but published on or after the international "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such docucitation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or ments, such combination being obvious to a person skilled in the art. document published prior to the international filing date but later than the priority date claimed "8" document member of the same patent family Date of the actual completion of the international search Date of mailing of the international search report 9 June 2000 19/06/2000 Name and mailing address of the ISA Authorized officer European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016 Riba Vilanova, M



### INTERNATIONAL SEARCH REPORT

Inte onal Application No PCT/EP 00/00932

	•	PCT/EP 00/00932
	ation) DOCUMENTS CONSIDERED TO BE RELEVANT	
Category •	Citation of document, with Indication, where appropriate, of the relevant passages	Refevant to dam No.
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Α .	WO 94 19502 A (UNION MINIERE SA ;STRAUVEN IVAN A J (BE); MEEUS MARCEL L (BE)) 1 September 1994 (1994-09-01) cited in the application * whole document * page 3, line 14 - line 31 examples claims	1-10
A	US 5 082 622 A (STRAUVEN YVAN ET AL) 21 January 1992 (1992-01-21) cited in the application column 1, line 49 -column 2, line 24; table claims	1-10
A	WO 96 06196 A (UNION MINIERE SA ;STRAUVEN IVAN A J (BE); MEEUS MARCEL L (BE)) 29 February 1996 (1996-02-29) page 3, line 1 - line 18 examples claims	1-10
A	WO 96 07765 A (UNION MINIERE SA ;STRAUVEN IVAN A J (BE); MEEUS MARCEL L (BE)) 14 March 1996 (1996-03-14) page 3, line 14 - line 29 examples claims	1-10



### INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. ional Application No PCT/EP 00/00932

	itent document I in search report		Publication date	1	Patent family member(s)	Publication date
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Form PCT/ISA/210 (patent tamby annex) (July 1992)

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03/07 '01 DIN 08:49 FAX 32 14 245873

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Table 3: Discharge time of batteries prepared with centrifugally atomised vs. gas jet atomised powders

Ex. No.	Alloy powder additives (ppm)				/es	(144)	O, % by Volume	Discharge time (%)
	In	Bi	Ca	Al	Pb		•	
(29)	160	230	-	•	46	С	2.35	102
(30)	160	230	-	-	46	C	0.6	90
(31)	160	230	-	-	46	G	2.35	87
(32)	160	230	_	-	46	G	0.6	61
							,	

(\*\*\*): 'C': centrifugal atomized powder; 'G':powder preparation by gas jet atomisation

The results of Experiment 3 are the following:

- both discharge times for centrifugally atomised powders are within the claimed range of 90-110% of the discharge time of the standard powder. 2.35%
   O<sub>2</sub> yields a better capacity than 0.6% O<sub>2</sub>.
  - both discharge times for the gas atomised powder are significantly lower than the discharge times of powders atomised centrifugally in gas with the same composition of the powder and of the protective atmosphere, and are less than 90%.

In Table 4 additional results for powders prepared by centrifugal atomisation according to the invention are given. They have been prepared and tested following the procedure of Experiment 1.

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Table 4: Volume expansion of different centrifugally atomised powders

Ex. No.	Alloy powder additives (ppm)			ves	O, % by Volume	Volume expansion (%)	
	In	Bi	Ca	Al	Pb		
(33)	250	250	150	-	-	0.6	3.3
(34)	500	110	_	35	-	0.6	1.9
(35)	500	110	-	35	-	1.35	2.5
(36)	500	110	-	35	-	1.6	2.1
(37)	500	110	-	35	-	2.1	6.7
(38)	500	110	-	35	_	2.6	7.6
(39)	150	230	-	-	-	1.6	5.5
(40)	200	100	-	100	-	1.6	4.0
(41)	200	100	-	100		2.6	2.9
(42)	150	230	-	-	-	0	5.6
(43)	150	230	-	-	-	2	7.3
(44)	200	100	-	100	<b>4</b> 0	2	2.7
(45)	150	230	-	-	38	2.45	6.7
(46)	150	230	-	-	55	0.25	5.0
(47)	200	100	-	100	40	3.5	3.7

#### From the

#### INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

KNOCKAERT, Guy N.V. UNION MINIERE S.A. Patent Department Kasteelstraat 7 B-2250 Olen BELGIQUE

## PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing

(day/month/year)

24.11.2000

Applicant's or agent's file reference

211

IMPORTANT NOTIFICATION

International application No. PCT/EP00/00932

International filing date (day/month/year) 03/02/2000

Priority date (day/month/year)

09/02/1999

**Applicant** 

N.V. UNION MINIERE S.A. et al.

- 1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
- 2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
- 3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

#### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/

European Patent Office D-80298 Munich

Tel. +49 89 2399 - 0 Tx: 523656 epmu d

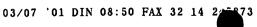
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### **PATENT COOPERATION TREATY**

## **PCT**

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Appl	icant's	or age	nt's file reference			See Notif	ication of Transmittal of International		
211		_		FOR FURTHER AC	TION		ry Examination Report (Form PCT/IPEA/416)		
International application No.			cation No.	International filing date (d	day/month	/year)	Priority date (day/month/year)		
PCT/EP00/00932 03/0			932	03/02/2000			09/02/1999		
H01	nationa 1 M4/4:		nt Classification (IPC) or na	ational classification and IPC	· 	,			
N.V	. UNIC	N NC	IINIERE S.A. et al.		<u></u>				
	and is	trans	smitted to the applicant	according to Article 36.			ternational Preliminary Examining Authority		
2.	This F	EPO	RT consists of a total of	f 6 sheets, including this	cover sl	neet.			
	ь	en a	mended and are the ba	ed by ANNEXES, i.e. she sis for this report and/or 607 of the Administrative	sheets c	ontaining	on, claims and/or drawings which have rectifications made before this Authority the PCT).		
	These	ann	exes consist of a total o	f 2 sheets.					
3.	This re	port	contains indications rel	ating to the following iter	ns:				
	ı	Ø	Basis of the report						
	П		Priority						
•	1111		Non-establishment of	opinion with regard to no	h regard to novelty, inventive step and industrial applicability				
	IV	X	Lack of unity of inventi	ion					
	٧	×		under Article 35(2) with re ions suporting such state		novelty, in	ventive step or industrial applicability;		
	VI		Certain documents cit	ted					
	VII		Certain defects in the	international application					
	VIII		Certain observations of	on the international appli	cation				
Date	of sub	missio	on of the demand		Date of	completion	of this report		
09/0	09/08/2000				24.11.2	000			
	Name and mailing address of the international preliminary examining authority:					ed officer	September 1997		
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523856 epmu d					Mizera				
	Fax: +49 89 2399 - 4465				Telepho	ne No. +49	89 2399 8580		

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/00932

ſ.	Bas	sis of the report				•				
1.	This report has been drawn on the basis of (substitute sheets which have been furnished to the receiving Office response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed the report since they do not contain amendments (Rules 70.16 and 70.17).): Description, pages:									
	1-7		as originally filed							
	8,9		as received on	28/10/2000	with letter of	25/10/2000				
	Claims, No.:									
	1-10		as originally filed							
2.			uage, all the elements m ntemational application v			shed to this Authority in th under this item.				
	These elements were available or furnished to this Authority in the following language: , which is:									
		☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).								
		the language of publication of the international application (under Rule 48.3(b)).								
		the language of a to 55.2 and/or 55.3).	ranslation furnished for t	he purposes of inter	national prelimin	ary examination (under Rule				
3.		With regard to any <b>nucleotide and/or amino acid sequence</b> disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:								
		□ contained in the international application in written form.								
		ifiled together with the international application in computer readable form.								
		furnished subsequently to this Authority in written form.								
		furnished subsequently to this Authority in computer readable form.								
		The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.								
		The statement that listing has been fur		in computer readat	ole form is identi	cal to the written sequence				
4.	The	amendments have	resulted in the cancellati	on of:		-				
		the description,	pages:							
		the claims,	Nos.:							
		the drawings,	sheets:							

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/00932

5.		This report has been exconsidered to go beyon			some of) the amendments had not been made, since they have been as filed (Rule 70.2(c)):					
		(Any replacement shee report.)	et contai	ining such	h amendments must be referred to under item 1 and annexed to this					
6.	Ado	ditional observations, if n	ecessaı	ry:						
IV.	. Lac	ck of unity of invention								
1.	In re	response to the invitation to restrict or pay additional fees the applicant has:								
		restricted the claims.								
		paid additional fees.								
		paid additional fees und	der prote	est.						
	×	neither restricted nor pa	aid addi	tional fee:	s.					
2.	×	This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.								
3.	This	his Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is								
		complied with.								
	☒	not complied with for th	e follow	ing reaso	ons:					
4.		Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:								
	×	all parts.								
		the parts relating to clai	ms Nos							
٧.		soned statement unde tions and explanations			vith regard to novelty, inventive step or industrial applicability; ch statement					
1.	Stat	ement								
	Nov	velty (N)	Yes: No:	Claims Claims						
	Inve	nventive step (IS) Yes: Claims No: Claims 1-10								
	Indu	istrial applicability (IA)	Yes:	Claims	1-10					

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP00/00932

No:

Claims

2. Citations and explanations see separate sheet

# INTERNATIONAL PRELIMINARY International application No. PCT/EP00/00932 EXAMINATION REPORT - SEPARATE SHEET

The following documents are cited:

D1: PATENT ABSTRACTS OF JAPAN vol. 013, no. 254 (E-772), 13 June 1989 (1989-06-13) & JP 01 052379 A (MITSUI MINING & SMELTING CO LTD:OTHERS: 01), 28 February 1989 (1989-02-28)

D2: WO 94 19502 A (UNION MINIERE SA ;STRAUVEN IVAN A J (BE); MEEUS MARCEL L (BE)) 1 September 1994 (1994-09-01) cited in the application

#### AS TO BOX IV:

- 1. Claim 1 comprises three alternatives which are linked by the presence of Zn and the amount of Bi as common feature. Such alloys, however, are already known from the prior art (see D2, claim 1, example 1 and p.1, l.19).
- 2. The process feature contained in this claim not being suitable to establish novelty of a product claim (see Box V), the alternatives contained in claim 1 lack unity 'a posteriori'.
- 3. Anyway possibly patentable subject matter only seems to be contained in a product claim in which the product is defined in terms of the essential product features. As claim 1 clearly does not meet the requirements of the PCT, no invitation to pay additional fees had to be sent.

#### AS TO BOX V:

- 1. Claim 1 differs from the disclosure of D2 only by features concerning the process used for the fabrication of the claimed powder (i.e. the powder prepared in D2 is obtained by atomizing the molten alloy in a jet of compressed air).
- According to the applicant, the powder of the invention exhibits a better corrosion resistance, which is claimed to be derivable from the gassing tests shown in Table
   1.
- 3. This argumentation, however, is not convincing. Alloy powders 11, 12 and 17, 18 exhibit a gassing behaviour that is at least as good as the gassing of the claimed

## INTERNATIONAL PRELIMINARY International application No. PCT/EP00/00932 EXAMINATION REPORT - SEPARATE SHEET

electrodes, although the experiments with these electrodes have been conducted in air.

- 4. Moreover product-by process claims are only acceptable in exceptional cases. In the present case it would have been easily possible to further characterize the claimed powder in terms of conventional parameters, such as particle size and oxygen content. Such a definition would have been absolutely necessary, as these parameters depend largely upon process parameters such as temperature, rotation speed and exact composition of the atmosphere used. In the lack of such parameters, the claimed product is not sufficiently defined in order to allow a reasonable comparison with the prior art. Novelty of claims 1-6 thus cannot be acknowledged (Art.33(2) PCT).
- 5. D1 deals with a problem that is also 'at the heart of the present invention', i.e. the reduction of hydrogen gas evolution in spite of a low amalgamation. D1 teaches also an atomization of Zn alloy powder at an oxygen content that is controlled to 4vol% or less. A skilled man dealing with gas atomization methods for the preparation of Zn alloy powder **must** be expected to know this document in this fairly limited technical area. He immediately gets the incentive to try the atmosphere used also according to claim1. Consequently the combination of the teachings of D1 and D2 is obvious. Claims 7-10, directed to methods for the production of the powder, thus lack an inventive step under Art.33(3)PCT.